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NASA-02345 (March 2003)  
NATIONAL AERONAUTICS NASA - KSC  
AND SPACE ADMINISTRATION SUPERSEDING NASA-02345  
(September 1999)  
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SECTION 02345

LIMEROCK STABILIZATION  
03/03

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NOTE: Delete, revise, or add to the text in this  
section to cover project requirements. Notes are  
for designer information and will not appear in the  
final project specification.  
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This section covers limerock stabilization for use  
as base course or subbase applied directly to a  
prepared subgrade. Base course is placed on a  
subgrade specified in Section 02210, "Site Grading."  
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PART 1 GENERAL

1.1 REFERENCES

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NOTE: The following references should not be  
manually edited except to add new references.  
References not used in the text will automatically  
be deleted from this section of the project  
specification.  
\*\*\*\*\*

The publications listed below form a part of this section to the extent  
referenced:

ASTM INTERNATIONAL (ASTM)

ASTM D 1556	(1990) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft) (2,700 kN-m/m)
ASTM D 2167	(1994) Standard Test Method for Density and Unit Weight of Soil In-Place by the Rubber-Balloon Method

ASTM D 75

(1987; R 1992) Standard Practice for  
Sampling Aggregates

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 621

(Rev A; Notice 2) Test Method for Pavement  
Subgrade, Subbase, and Base Course  
Materials

## 1.2 SUBMITTALS

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**NOTE: Review submittal description (SD) definitions in Section 01330, "Submittals," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.**

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The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

### SD-01 Preconstruction Submittals

Waybills or Delivery Tickets shall be submitted in accordance with the paragraph entitled "General" of this section

### SD-04 Samples

Unless otherwise directed, sampling of Limerock shall be in conformance with ASTM D 75, except for density tests. Samples for density tests shall conform to ASTM D 1557. The minimum size sample hole for the density test shall be 0.050 cubic foot 0.00014 cubic meter for 1/2-inch 13 millimeter maximum particle size, 0.075 cubic foot for 1-inch 0.002 cubic meter for 25 millimeter maximum particle size, and 0.100 cubic foot for 2-inch 0.0028 cubic meter for 50 millimeter maximum particle size. Samples to be used as the basis for final approval in determining density shall be obtained under observation of the Contracting Officer.

### SD-06 Test Reports

Test Reports from samples shall be submitted by the Contractor not less than 30 days before material is required in the work. Final approval of material shall be the completed layer ready for next layer.

## 1.3 DEFINITIONS

Degree of compaction shall conform to ASTM D 1556.

Coverage is the application of one tire print over each point in the surface of the designated area.

#### 1.4 QUALITY ASSURANCE

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory or by the Contractor, subject to approval. Tests shall be performed to ensure that materials meet specified requirements. Copies of test results shall be furnished to the Contracting Officer.

#### 1.5 OPERATION OF MATERIAL SOURCES

Clearing, stripping, and excavating involved in the operation of pits or quarries shall be performed by the Contractor. Pits or quarries on private lands shall be conditioned in agreement with the local laws and authorities.

### PART 2 PRODUCTS

#### 2.1 GENERAL

Limerock shall consist of fossiliferous limestone of uniform quality, containing no hard or flinty pieces to prevent construction of a smooth pavement surface free of pits or pockets. Limerock shall be obtained from pits where overburden has been removed previous to blasting. Limerock shall show no tendency to air-slake and shall undergo no chemical change when exposed to weather; it shall contain not more than three percent roots, leaf mold, or other organic matter. Broken limerock shall conform to the following gradation: 100 percent shall pass a 1-1/2-inch 38 millimeter mesh sieve and shall be continuously well graded down to dust. Fine materials shall consist of the dust and fine particles of fracture. In no case will material be permitted which has a liquid limit in excess of 25 or a plasticity index in excess of 5 when tested in accordance with Method 103 of MIL-STD 621. Chemical analysis of limerock shall consist of determining the insoluble silica, the iron oxide, and the alumina by solution of sample in hydrochloric acid; by evaporating, dehydrating, redissolving, and neutralizing the residue with ammonium hydroxide; and by filtering, washing, and igniting the residue limerock. The difference between the percentage of insoluble matter and 100 percent is reported as carbonates of calcium and magnesium. Limerock shall be either Ocala or Miami oolite.

Waybills or Delivery Tickets shall be submitted during progress of the work.

#### 2.2 OCALA LIMEROCK

Ocala limerock shall be composed of not less than 90 percent carbonates of calcium and magnesium from approved deposits.

#### 2.3 MIAMI OOLITE LIMEROCK

Miami oolite limerock shall be composed of not less than 75 percent

carbonates of calcium and magnesium and not more than 2 percent oxides of iron and aluminum. Any component other than the carbonates and oxides shall be silica.

## 2.4 TESTING

For purposes of geological designation, all Limerock mined north of the 28th degree parallel of latitude in the State of Florida shall be tested as and shall meet the requirements specified above for Ocala limerock; all limerock mined south of that parallel shall be tested as and shall meet the specified requirements for Miami oolite limerock. Test Reports shall be submitted for approval.

## PART 3 EXECUTION

### 3.1 EQUIPMENT

All plant, equipment, tools, and machines used in the performance of the work covered by this section shall be subject to approval by the Contracting Officer and shall be maintained in satisfactory working condition at all times.

#### 3.1.1 Rollers

Rollers shall be self-propelled and shall be of such a type and weight that sufficient compactive effort will be exerted on the stabilized area to obtain the required density.

#### 3.1.2 Blade Graders

Blade graders shall have a wheel base of not less than 15 feet 4570 millimeter, a blade of not less than 12 feet 3660 millimeter, and shall be self-propelled.

#### 3.1.3 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other equipment designed to apply water uniformly and at controlled quantities to variable widths of surface.

#### 3.1.4 Pulvermixer

Pulvermixer may be tow-type or self-propelled and shall have variable mixing speed to allow smooth, uniform mixes to the full depth of section shown on the drawings.

#### 3.1.5 Hauling Equipment

Hauling equipment shall consist of pneumatic-tired vehicles having dump bodies suitable for dumping materials on the subgrade or select material base course.

#### 3.1.6 Tampers

Hand tampers shall weigh not less than 50 pounds 23 kilograms and shall have a face area of not more than 100 square inches 0.065 square meter. Mechanical tampers shall be of an approved type.

#### 3.1.7 Miscellaneous Equipment

Scarifiers, tractors, spring-tooth or spike-tooth harrows, windrow equalizers, spreaders, and other equipment shall be of approved types, suitable for constructing stabilized aggregate base course.

#### 3.2 PREPARATION OF SUBGRADE

Prior to constructing the limerock stabilization, the subgrade shall be cleaned of foreign substances. Surface of the subgrade or subbase course shall be inspected for adequate surface tolerances.

Ruts or soft, yielding spots that may appear in the subgrade or subbase course, areas having inadequate compaction, and deviations of the surface from the requirements in the applicable section shall be corrected. Correction shall be performed by loosening the affected areas, removing unsatisfactory material, adding approved material, and by reshaping and recompacting to line and grade to the specified density requirements, as directed.

#### 3.3 GRADE CONTROL

The finished and completed surface course shall conform to lines, grades, cross sections, and dimensions as indicated. Lines and grades shall be maintained as indicated by means of line and grade stakes placed at the worksite.

#### 3.4 FURNISHING WATER

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**NOTE: When the "special provisions" adequately  
provide for sufficient water for the construction of  
the base course, this paragraph must be deleted.**  
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Provisions shall be made by the Contractor for furnishing water at the site of the work by equipment of such capacity and design as will ensure application of the approved amounts of each of the construction operations in the following paragraphs.

#### 3.5 PLACING AND MIXING OF MATERIALS

The loads of stabilizing material shall be spotted on the area to be established according to theoretical yield, as computed by the following formula:

$$\text{Area in Sq Yd} = \frac{\text{No. of Cu Yd in load} \times \text{Meter} \times \frac{36}{\text{No. of inches millimeter of loose measure limerock required}}}{1}$$

Stabilizing material shall be placed and spread uniformly to such a depth and width, that when the work is completed, the requirements of the typical cross section will have been fulfilled. Stabilizing material shall be thoroughly mixed with the soil by a pulvermixer and bladed until the treated areas are uniform. Surface shall then have water added as required and be bladed, shaped, and smoothed so that it will compact to the grade and typical cross section required.

### 3.6 COMPACTION

When the stabilized areas have been bladed, shaped, and smoothed to the grades or levels required, the areas shall have water added as required and shall be rolled with tamping rollers, power rollers, or by combination thereof. Rolling shall continue until the layer or layers are compacted through the full depth to at least 100 percent of the maximum density as determined by test procedure presented in MIL-STD 621, Method 100, Compaction Effort Designation CE-55. Surface of the layer shall be finished by blading and rolling with a power roller or rubber-tired rollers, or combination thereof. In all places not accessible to the rolling equipment, the mixture shall be compacted with tamping equipment as specified. Blading, rolling, and tamping shall continue until the surface is smooth and free from waves and inequalities. If at any time the mixture is excessively moistened by rain, it shall be aerated by means of blade graders, harrows, or other approved equipment, until the moisture content of the mixture is satisfactory; the surface shall then be recompact and finished as specified above.

### 3.7 TESTS

#### 3.7.1 Smoothness Test

Surface shall show no deviations in excess of 3/8 inch 10 millimeter when tested with a 10-foot 3050 millimeter straightedge applied parallel with and at right angles to the centerline of the paved areas. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, reshaping, watering, and compacting.

#### 3.7.2 Thickness

Thickness of the stabilized subbase, shoulder, or other areas shall be not less than that shown on the drawings, and shall be measured at intervals in such a manner that there will be a depth measurement for at least 500 square yards 418 square meter of completed stabilization. Depth measurements shall be made by test holes, at least 3 inches 75 millimeter in diameter through the subbase, shoulder, or other areas. Where the deficiency is more than 1/2 inch 13 millimeter, the Contractor shall correct such areas by scarifying, adding stabilizing material, watering, reblading, and recompact. Where the thickness is more than called for on the drawings, it shall be considered as the specified requirement.

#### 3.7.3 Density Control

During construction and upon completion of the stabilized area, field



density tests shall be performed in sufficient numbers to ensure that required density is being obtained. These tests shall be made by the Contractor and shall be in accordance with ASTM D 1556, Method D, or ASTM D 2167, except that the volume occupied by the sample prior to removal shall not be determined through the use of oil.

-- End of Section --